भारतीय मानक
Indian Standard

IS 802 (Part 4) : 2023

शिरोपरि प्रेषण लाईन टावरों में संरचना इस्पात का उपयोग — रीति संहिता

भाग 4 लैटिस्ड स्विचयार्ड संरचनाओं के लिए आवश्यकताएँ

Use of Structural Steel in Overhead Transmission Line Towers — Code of Practice

Part 4 Requirements for Latticed Switchyard Structures

ICS 91.080.10

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March 2023 Price Group 9

Structural Engineering and Structural Sections Sectional Committee, CED 07

FOREWORD

This Indian Standard (Part 4) was adopted by the Bureau of Indian Standards, after the draft finalized by the Structural Engineering and Structural Sections Sectional Committee had been approved by the Civil Engineering Division Council.

Transmission towers are tall structures, usually steel lattice towers, used to support overhead powers lines. Transmission line towers are key infrastructural components. The standards under IS 802 series have been formulated with a view to establish uniform practices for design, fabrication, inspection and testing of overhead transmission line towers.

This standard (Part 4) aims to provide general guidelines for requirements of materials and loads for lattice switchyard and substation structures. The other parts in the series are:

Part 1 Material, loads and design strengths, permissible stresses

Sec 1 Material and loads

Sec 2 Design strengths

Part 2 Fabrication, galvanizing, inspection and packing

Part 3 Testing

Part 5 Requirements for tall river crossing towers (*under preparation*)

Part 6 Erection methodology

While formulating this standard, practices prevailing in the country in this field have been kept in view. Assistance has been derived from the following publications:

Design of Latticed Steel Transmission Structures, ASCE-10-15.

The composition of the Committee responsible for the formulation of this standard is given in Annex B.

For the purpose of deciding whether a particular requirement of this standard is complied with the final value, observed or calculated, expressing the result of a test or analysis shall he rounded off in accordance with IS 2 : 2022 ‘Rules for rounding off numerical values (*second revision*)’. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

USE OF STRUCTURAL STEEL IN OVERHEAD TRANSMISSION LINE TOWERS — CODE OF PRACTICE

PART 4 REQUIREMENTS FOR LATTICED SWITCHYARD STRUCTURES

1 SCOPE

1.1 This standard (Part 4) stipulates materials and loads to be adopted in the design of latticed switchyard structures for overhead transmission network.

1.1.1 Permissible stresses and other design parameters are covered in IS 802 (Part 1/Sec 2) of this standard. Provisions on fabrication including galvanizing, inspection and packing have been covered in IS 802 (Part 2) and same shall be considered as valid for this standard.

1.2 This standard does not cover any tubular (cement or steel), RCC or girder/channel supported/weld fabricated structures.

2 REFERENCES

The standards listed in Annex A contain provisions which through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated.

3 TERMINOLOGY

For the purpose of this standard the definitions given in IS 802 (Part 1/Sec 1) shall apply.

4 STATUTORY REQUIREMENTS

4.1 Statutory requirements, as laid down in the '*Indian Electricity Rules,* 2005' or by any other governing statutory body, applicable to such structures as covered in this standard, shall be satisfied.

4.2 In addition to compliance with local and provincial byelaws, fire and safety laws [as per the provisions of IS 5613 (Part 2/Sec 2)] and civil aviation requirements/electricity rules shall be applicable to such structures, as specified by the purchaser/end user shall be complied with.

5 MATERIALS

5.1 Structural Steel

Structural steel of any grade, as appropriate, conforming to IS 2062 shall be used.

5.1.1 Structural steel other than that specified in **5.1** with known properties conforming to other national and international standards may also be used subject to the approval of the purchaser.

5.2 Bolts

Bolts for connections shall conform to IS 12427. Foundation bolts shall conform to IS 5624. Step bolts shall conform to IS 10238.

5.3 Nuts

Nuts shall conform to IS 14394. The mechanical properties shall conform to property class 5 or class 8 as the case may be.

5.4 Washers

5.4.1 Washers shall conform to IS 2016 with thickness as required based on connection details. Spring washers shall conform to type B of IS 3063. Heavy washers shall conform to IS 6610.

5.4.2 Washers to be used with high strength bolts and nuts shall conform to IS 6649.

5.5 Galvanization

5.5.1 Tower members shall be galvanized in accordance with the provisions of IS 4759.

5.5.2 Threaded fasteners shall be galvanized to conform to the requirements of IS 1367 (Part 13).

5.5.3 Spring washers shall be electro galvanized as per grade B of IS 1573 as and plain washers shall be hot dip galvanized as per service Grade 4 of IS 4759 or electro galvanized as per service Grade 3 of IS 1573 as specified by the purchaser/end user.

5.6 Other Materials

Other material used in the construction of switch yard structures shall conform to appropriate Indian Standards, wherever available.

6 TYPES OF STRUCTURES

6.1 The latticed switch yard structures shall broadly be classified as gantry structures, equipment support structures and masts.

6.2 Gantry Structures

6.2.1 The latticed gantry structure shall mean a latticed beam supported by two latticed columns or towers. The gantry structures can be designated according to their position in switch yard, such as line gantry, bus gantry and transformer/reactor gantry (*see* Fig. 1).

6.2.2 *Beam*

Depending upon the switch yard layout, the beams will be designed to carry the three point loads of phase conductors of an electrical circuit (single circuit) at equal or unequal distance in one direction in plan. The beam may also carry three point loads of an electrical circuit (single circuit) pilot insulator string wave trap and jumpers in elevation at the centre point viewed in the bottom plan of beam (*see* Fig. 2).

6.2.3 *Columns*

The gantry columns shall be designed to take the loads derived from the reaction of the beam on the different loading conditions. The gantry column may support number of beams on its four faces at one or more elevation levels. The column may also support the earth wire or OPGW provided to shield the conductor at an appropriate height (*see* Fig. 3).

6.3 Equipment Support Structures

These are required for supporting the switch yard equipment at an appropriate height above final finished ground level so as to maintain safe electrical clearance as per electricity act and rules. These structures generally support circuit breakers, current transformers, potential transformers, isolators, capacitor voltage transformers, wave trap, post insulator, lightning arresters, capacitor banks and other similar equipment (*see* Fig. 4).

6.4 Masts

The latticed mast shall mean structures erected to mount shield wires, lightning electrodes, communication antenna/gadgets, watch and ward posts, illumination systems and shall be designed for wind loads acting perpendicular/diagonal to one face of mast (*see* Fig. 5).

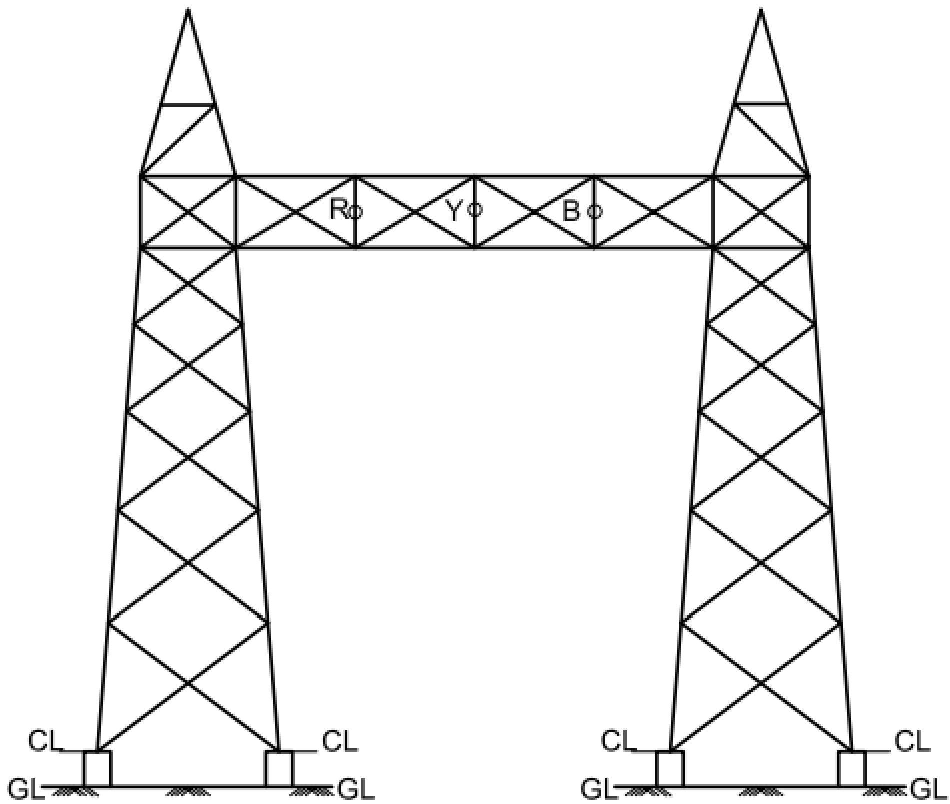


FIG. 1 GANTRY STRUCTURE

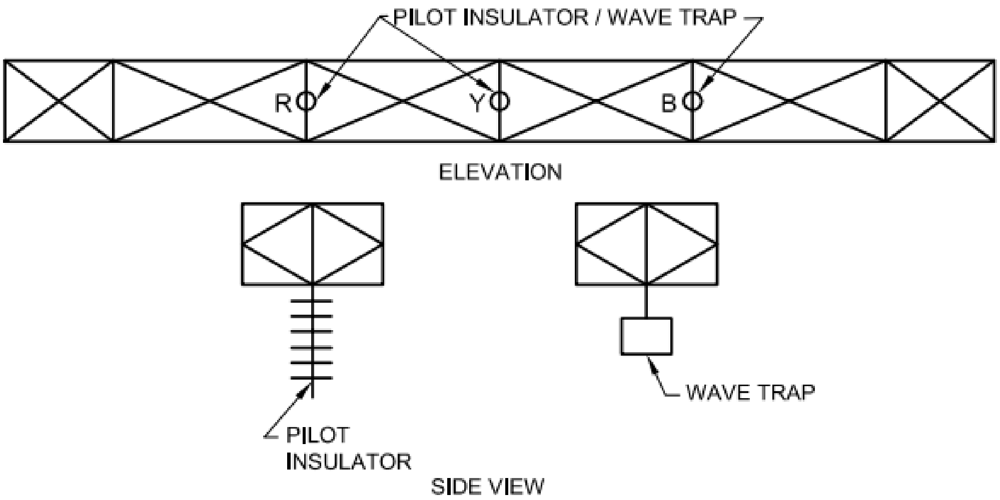


FIG. 2 BEAM OF GANTRY STRUCTURE

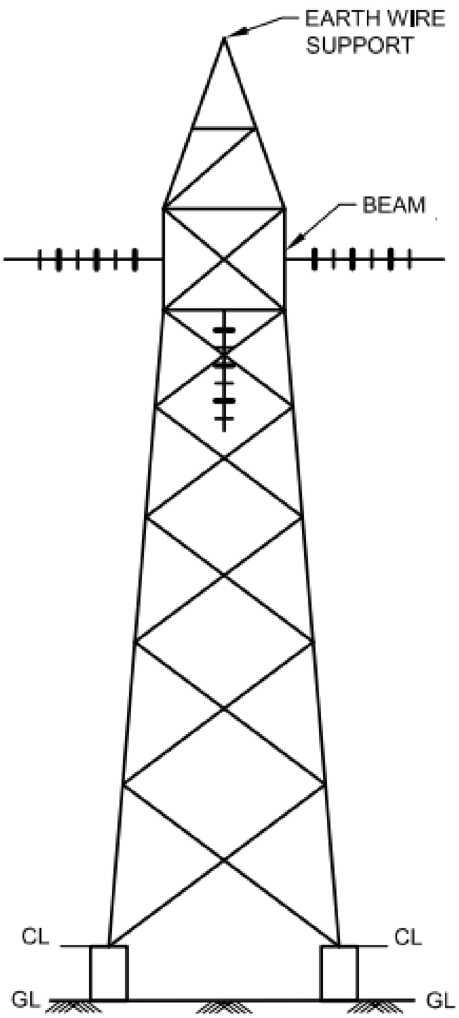
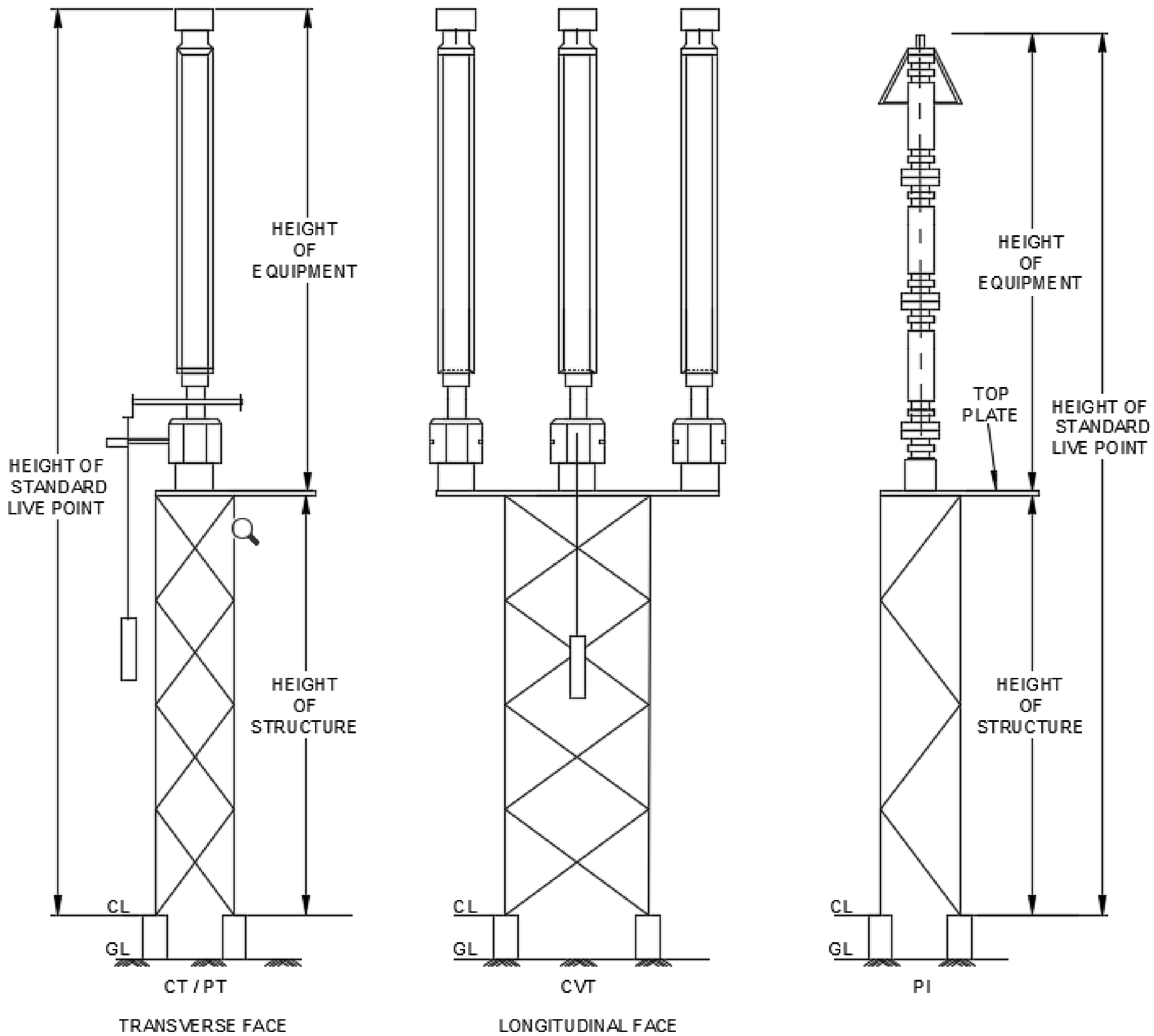
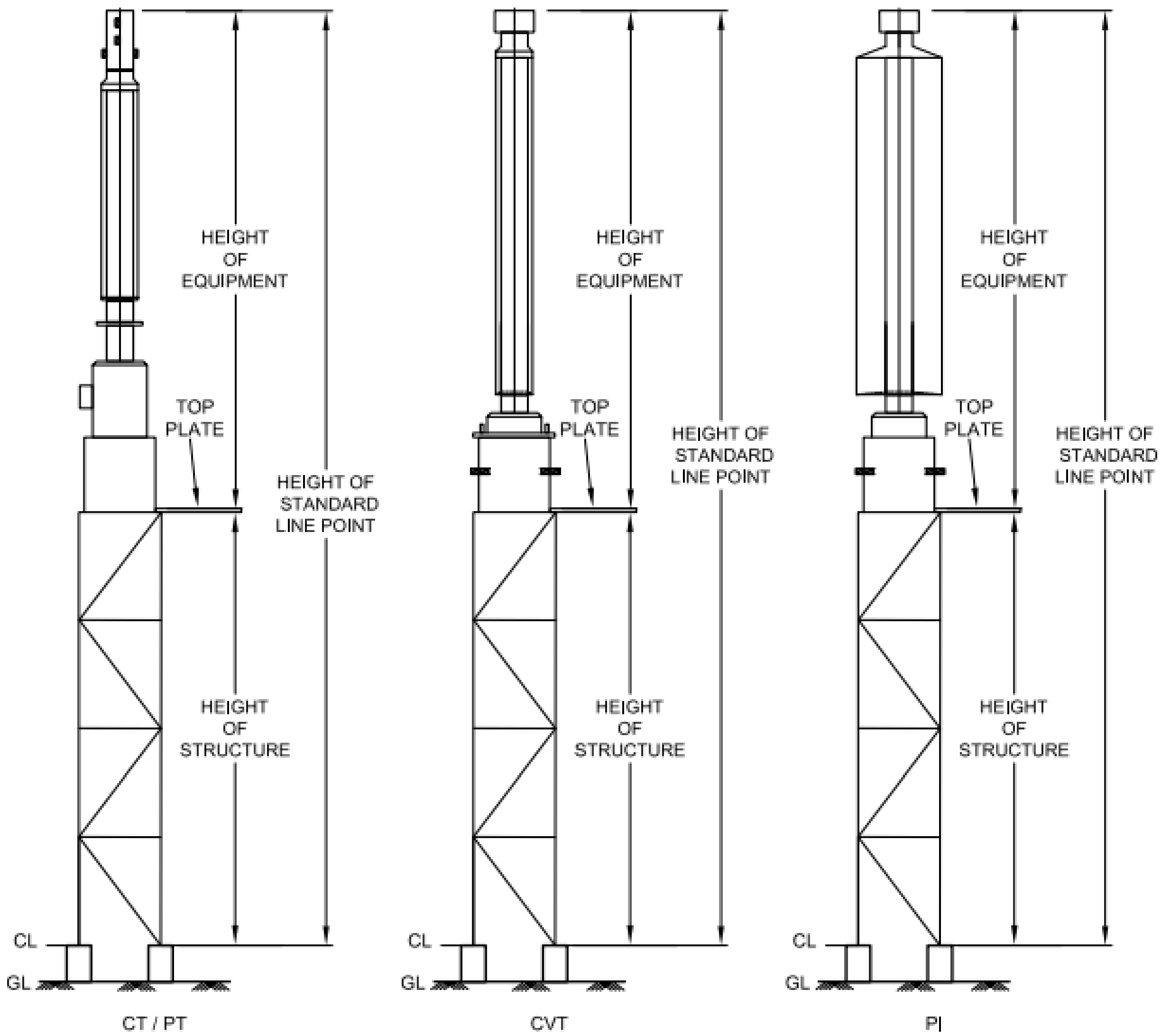


FIG.3 GANTRY COLUMN



ISOLATOR

LIGHTNING ARRESTER



C.L. - Concrete Level
G.L. - Ground Level
CT/PT - Current Transformer and Potential Transformer
CVT - Capacitor Voltage Transformer
PI - Post Insulators

FIG. 4 EQUIPMENT SUPPORT STRUCTURES

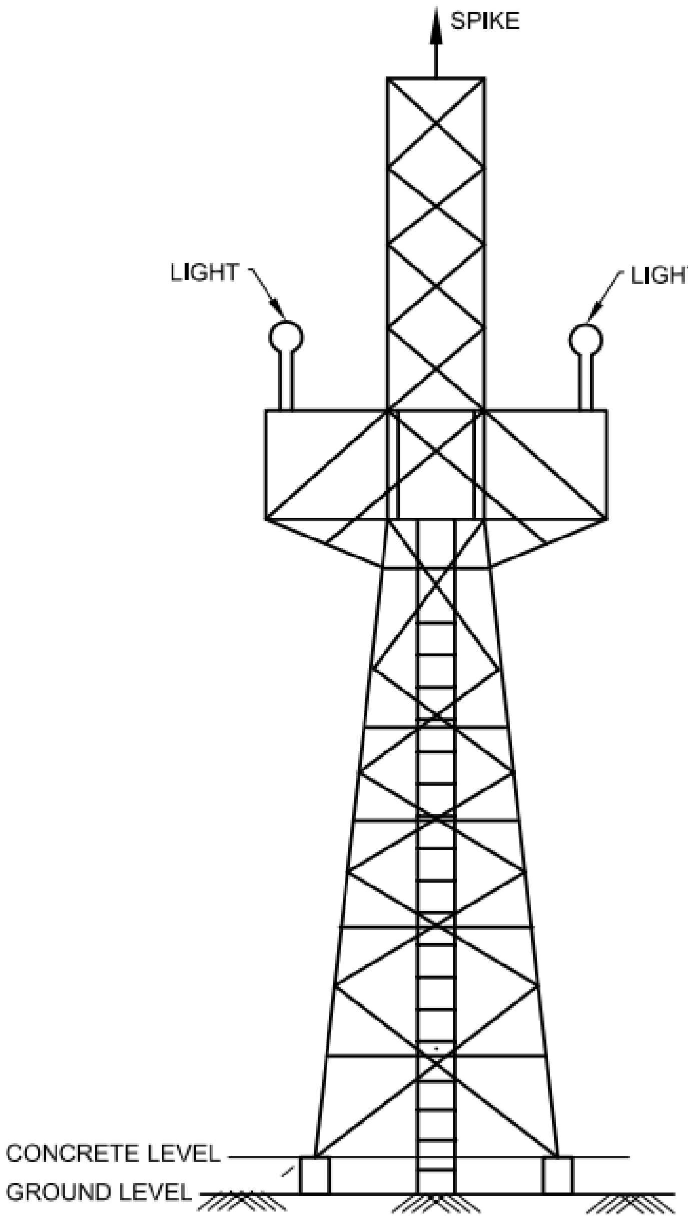


FIG. 5 MAST

7 WIND EFFECTS

7.1 Basic Wind Speed, V_b

The basic wind speed shall be as specified in IS 875 (Part 3).

7.2 Design Wind Speed, V_d

The design wind speed shall be as specified in IS 802 (Part 1/Sec 1).

7.3 Design Wind Pressure, P_d

7.3.1 Design wind pressure P_d for two reliability levels and pertaining to six wind zones and three terrain categories shall conform to that specified in IS 802 (Part 1/Sec 1).

7.4 Terrain Category

Terrain Category for design of structure shall be considered as per IS 875 (Part 3).

8 WIND LOADS

8.1 Wind Load on Structure and Equipment

8.1.1 *Column with Only One Beam Connection*

For determining the wind load on column, the column is divided into one full panel having a height '*h*' between the centre line of a beam and the concrete level of column. For a lattice column, the resultant wind load, F_{wt} for a wind normal to the longitudinal face of column on a panel height *h* applied at the centre of gravity of the panel, is given by:

$$F_{wt} = P_d \, C_{dt} \, A_e \, G_T$$

where

F_{wt} = wind load on column, in N;

P_d = design wind pressure, in N/m²; and

C_{dt} = drag co-efficient for panel under consideration against which the wind is blowing.

Value of C_{dt} for different solidity ratio shall be considered as under:

Solidity Ratio	*Drag Coefficient*
Up to 0.05	3.6
0.1	3.4
0.2	2.9
0.3	2.5
0.4	2.2
0.5 and above	2.0

NOTE — Solidity ratio is equal to the effective area (projected area of all the individual elements) of a frame normal to the wind direction divided by the area enclosed by the boundary of the frame normal to the wind direction.

A_e = Total net surface area of the legs, bracings and secondary members of the column panel projected normal to the face in m² (projection of the bracing elements of the adjacent faces and of the plan-and-hip bracing bars may be neglected while determining the projected surface of a face under consideration); and

G_T = Gust response factor peculiar to the ground roughness and depends on the height above ground. Value of G_T for the three terrain categories are given in Table 6 of IS 802 (Part 1/Sec 1).

8.1.2 *Column with more than one Beam Connection at Different Levels*

For determining the wind load on column of this nature, the column is divided between the two beam's level of a column shaft and the wind load is divided equally at the center of top beam level and the bottom beam level, while the wind load for a column between bottom beam level and the concrete level of a column, is calculated as in **8.1.1**.

8.1.3 *Beam*

For determining the wind load on beam, the beam is divided into one full panel having a length, ℓ between the clear span of two columns and the wind load is considered to be uniformly distributed over a length, ℓ and the plan face of beam designed accordingly (*refer* Fig. 6).

8.1.4 *Equipment Support Structure*

For determining the wind load on equipment support structure, the support structure is divided into one full panel having height, h between the top and the concrete level of structure. The resultant wind load F_{wt} for a wind normal to the longitudinal face of structure on a panel height h applied at the centre of gravity of this panel, is given by:

$$F_{wt} = P_d \, C_{dt} \, A_e \, G_T$$

In addition to the wind load as above, wind load on equipment mounted on the support structure is also considered to act on structure (*refer* Fig. 9).

8.1.5 *Equipment*

For determining the wind load on equipment, the equipment is considered to be one full panel of height, h and the wind load is distributed in two equal parts acting on top and bottom of equipment (*refer* Fig. 9).

8.1.6 *Wind Load on Masts*

Wind load on masts shall be considered on each panel of the mast. The wind load on the equipment/wires mounted on them shall also be considered (*refer* Fig. 5).

8.2 Wind on Conductor and Ground Wire

8.2.1 The load due to wind on each conductor and ground wire/OPGW, F_{wc} applied at supporting point normal to the line considered as transverse wind load condition, shall be determined by the following expression:

$$F_{wc} = P_d \, C_{dc} \, L \, d \, G_c$$

where

P_d = design wind pressure, in N/m²;

C_{dc} = drag coefficient taken as 1.0 for conductor and 1.2 for ground wire;

L = *wind span,* being the sum of half the span on either side of supporting point, in meters;

D = diameter of cable, in meters; and

G_c = gust response factor that takes into account the turbulence of the wind conductor. Values of G_c are given in Table 7 of IS 802 (Part 1/Sec 1) for the three terrain categories and average height of the conductor/ground wire above the ground.

NOTE — The average height of conductor/ground wire shall be taken up to the clamping point of conductor/ground wire on beam or column.

8.2.2 The total effect of wind on bundle conductors shall be taken equal to the sum of the wind load on sub-conductors without accounting for a possible masking effect of one of the sub conductors on another.

8.3 Wind Load on Insulators Strings

8.3.1 Wind load on insulators strings, F_{wi} shall be determined from the attachment point to the center line of the conductor in case of suspension insulator string and up to the end of clamp in case of tension insulator string, in the direction of the wind, by the following equation:

$$F_{wi} = C_{di} P_d A_i G_i$$

where

- C_{di} = drag coefficient, to be taken as 1.2;
- P_d = design wind pressure, in N/m²;
- A_i = 50 percent of the area of insulator string projected on a plane which is parallel to the longitudinal axis of the string; and
- G_i = gust response factor, peculiar to the ground roughness and depends on the height of insulator attachment point above ground.

8.3.2 In case of multiple strings, no masking effect shall be considered on the leeward insulator strings.

9 TEMPERATURE EFFECTS

9.1 General

The temperature range varies for different locations of the switchyards under different seasonal conditions. The absolute maximum and minimum temperature which may be expected in different locations in the country are given in IS 802 (Part 1/Sec 1). The temperatures indicated in these maps are the air temperatures in shade. These may be used for assessing the temperature effects.

9.2 Temperature Variations

9.2.1 The absolute maximum temperature may be assumed as the higher adjacent isopleth temperature shown in IS 802 (Part 1/Sec 1).

9.2.2 The absolute minimum temperature may be assumed as the lower adjacent isopleth temperature shown in of IS 802 (Part 1/Sec 1).

9.2.3 The average everyday temperature shall be 32°C anywhere in the country, except in regions experiencing minimum temperature of –5°C or lower, where everyday temperature may be taken as 15°C or as specified by the power utility/user.

9.2.4 The maximum conductor temperature may be obtained after allowing increase in temperature due to radiation and heating effect due to current over the absolute maximum temperature given in **9.2.1**. The beam/column may generally be designed to suit the conductor temperature of 85°C (*Max*) for Aluminium Conductor Steel Reinforced (ACSR) and for All Aluminium Alloy Conductor (AAAC). The maximum temperature of ground wire exposed to sun may be taken as 53°C. If the new generation conductors such as AL-59, Aluminium Conductor Steel Supported (ACSS) Trapezoid Wire (TW), gap conductor, Aluminium Composite Core Conductor (ACCC) etc, are deployed, maximum allowable temperature of the conductor based on the permissible/designed ampacity, shall be considered.

9.2.5 The minimum every day and maximum temperature of the conductors shall be specified by the user or mutually agreed with the user.

9.3 Sag Tension

Sag tension calculation for conductor and ground wire shall be made in accordance with the relevant provisions of IS 5613 (Part 2/Sec 1) for the following conditions:

a) 100 percent design wind pressure at everyday temperature or 36 percent design wind pressure at minimum temperature after accounting for drag co-efficient and gust response factor (design wind pressure = P_d C_{dc} G_c).
b) The values of sag and tension on conductor shall be corrected to account for the weight tension and wind effect on the droppers.
c) Effect of insulator weight, spacer weight, dropper weight and weight of other hardware to be considered suitably in the sag tension calculations.

10 LOADS ON BEAM AND COLUMN

10.1 Type of Loads

Switchyard structures are subjected to various loading conditions during their lifetime. These loads are classified into two distinct categories, namely:

a) Normal Condition Loadings (N.C); and
b) Short Circuit Forces (S.C.F)

10.2 Climatic Loads

These are random loads imposed on column, insulator string, conductor and ground wire due to action of wind on conductor and do not act continuously. Climatic loads shall be determined under the following climatic conditions:

a) Condition 1:100 percent of design wind pressure at everyday temperature (design wind pressure = P_d C_{dc} G_c); and
b) Condition 2:36 percent design wind pressure at minimum temperature.

10.3 The mechanical tension of conductor/ground wire is the tension corresponding to 100 percent of

design wind pressure at everyday temperature or 36 percent of design pressure at minimum temperature after accounting for drag co-efficient and gust response factor. Mechanical tension shall be considered as a longitudinal load for reliability condition and security condition.

10.4 For strung bus and line conductors, the sag tension calculations shall be started considering the working tension of conductor and ground wire at 5 percent of ultimate tensile strength of conductor, ground wire/OPGW at everyday temperature and no wind condition. For pipe conductors, the change in mechanical tension due to wind shall be considered as zero. However, transverse load due to wind shall be computed based on the exposed area of the pipe. In the snow bound regions, the effect of snow on diameter of conductor and weight shall be taken into account for sag tension calculations.

10.5 Intermediate Beam of Bus Bay

The following loads shall apply:

a) *Transverse Load* — Wind acting on half span length shall be considered (half span from both the sides);
b) *Vertical Load* — Weight of wire for half span length shall be considered (half span from both the sides); and
c) *Longitudinal Load* — 50 percent of conductor/ground wire tension at everyday temperature and full wind shall be considered or minimum temperature and 0.36 times full wind shall be considered.

10.6 End Beam of Bus Bay

The following loads shall apply:

a) *Transverse Load* — Wind acting on half span length shall be considered (half span from one side);
b) *Vertical Load* — Weight of wire for half span length shall be considered (half span from one side); and
c) *Longitudinal Load* — 100 percent of conductor/ground wire tension at everyday temperature and full wind shall be considered or minimum temperature and 0.36 times full wind shall be considered.

10.7 End Beam of Line Bay

The following loads shall apply:

a) *Transverse Load* — Wind acting on half the span length between terminal tower of transmission line and the end beam (gantry).
b) *Vertical Load* — Weight of wires for half the span length between terminal tower of transmission line and the end beam (gantry).
c) *Longitudinal Load* — 100 percent of conductor/ground wire/OPGW/tension at everyday temperature and full wind shall be considered or minimum temperature and 0.36 time full wind shall be considered.
d) *Angle of deviation* — The end beam in line bay shall be designed with an angle of 30° in plan and 30° in elevation with reference to the centre line of the beam. The longitudinal loads as given in (c) above shall be worked out as a horizontal component of tensions of conductors/earth wire/OPGW acting in plan and elevation with 30° angles, as stated above (*see* Fig. 6).

10.8 Intermediate Beam of Line Bay

The following loads shall apply:

a) *Transverse Load* — Wind acting on half span length shall be considered (half span from both the sides);
b) *Vertical Load* — Weight of wire for half span length shall be considered (half span from both the sides); and
c) *Longitudinal Load* — 50 percent of conductor/ground wire tension at everyday temperature and full wind shall be considered or minimum temperature and 0.36 times full wind shall be considered.

11 COMPUTATION OF LOADS

11.1 Transverse Loads

Transverse loads shall be computed for reliability requirement (normal condition).

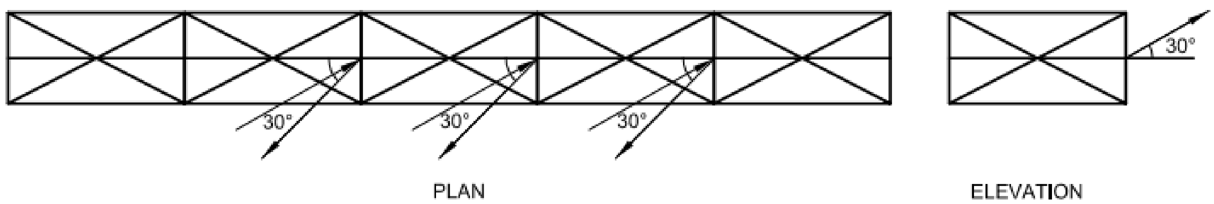


FIG. 6 END BEAM OF LINE BAY

11.1.1 *Reliability Requirement (Normal Condition)*

Loads shall be calculated as follows:

a) Wind action on column/beam structures, conductors/ground wires and insulator strings computed according to **8.1**, **8.2** and **8.3**, respectively for the climatic condition specified **10.2**(a).
b) Component of mechanical tension, F_{wd} of conductor and ground wire due to wind computed according to **10.3**.

Total transverse load = (a) + (b) = $F_{wt} + F_{wc} + F_{wi} + F_{wd}$

where

F_{wc}, F_{wi}, and F_{wd} are to be applied on all conductor/ground wire points and F_{wt} to be applied on column at ground wire peak level, at the centre of beam levels and at the base of column.

11.2 Vertical Loads

Vertical loads shall be computed for reliability requirement (normal condition).

11.2.1 *Reliability Requirements* (*Normal Condition*)

The loads shall comprise the following:

a) Loads due to weight of conductors/ground wire/OPGW based on design span, weight of insulators strings and accessories; and
b) Self-weight of column structure up to point/level under consideration.

11.3 Longitudinal Loads and Short Circuit Forces

Longitudinal loads shall be computed for reliability (normal condition) and security (short circuit condition) requirements as under.

11.3.1 *Strung Conductors*

For reliability requirement, the maximum tension derived for design from sag tension calculation at everyday temperature and maximum wind shall be considered. In addition, 25 percent of the short circuit forces specified shall be included in longitudinal tension. For security requirement, 100 percent short circuit forces specified shall be taken along with longitudinal tension at minimum temperature and 36 percent wind.

11.3.2 *Pipe Conductors*

For reliability and security requirements only 100 percent short circuit forces specified shall be considered.

12 DESIGN CRITERIA

12.1 The following conditions to be considered while calculating loading on beam (*see* Fig. 7):

a) The loads due to conductor tension, wind and short circuit shall be considered to be acting on the beam;
b) The wind load on the beam shall be considered as a running load on the plan frames of the beam;
c) The self-weight of the beam shall be considered as a running load on the elevation frames of the beam;
d) The vertical loads due to conductor weight, insulator weight and line man with tools shall considered to be acting as a point loads on the elevation frames of the beam; and
e) The longitudinal loads due to conductor tension and short circuit force shall consider to be acting on the plan frames of the beam.

12.2 The loadings on the beam shall be worked out for the following two distinct cases of wind flow (*see* Fig. 8).

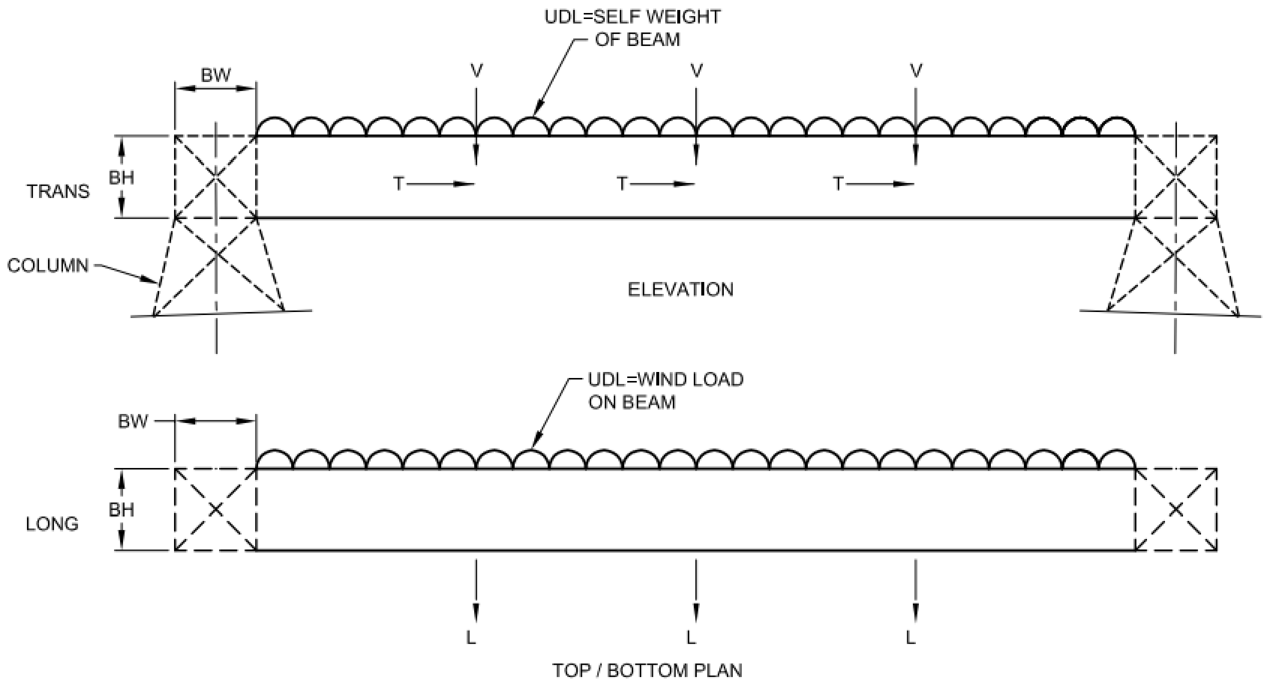
a) Case 1 — Wind perpendicular to conductor or parallel to beam; and
b) Case 2 — Wind parallel to conductor or perpendicular to beam.

12.3 The loadings on the columns in different directions shall be the resultant reaction of the beam in different directions of loadings (*see* Fig. 8).

12.4 In addition to the loadings due to reactions of beam (due to different directional loads), the load due to wind acting on the column and the self-weight of the column shall be added while designing the column (*see* Fig. 9).

12.5 The equipment support structures shall be designed for the weight of the equipment, self-weight of the structure, tensions of strung conductor, wind on strung conductor or pipe, wind on equipment and the support structure. Short circuit forces shall also be considered as acting on the equipment and getting it transferred to the structure along the strung conductor or pipe (*see* Fig. 10).

The other structures like, lightning mast, lighting mast watch and ward towers etc. shall be designed for wind loads and self–weight.



UDL – Uniformly distributed load

L – Longitudinal load at each phase point

V – Vertical load at each phase point

Fig. 7 Loadings on Beam

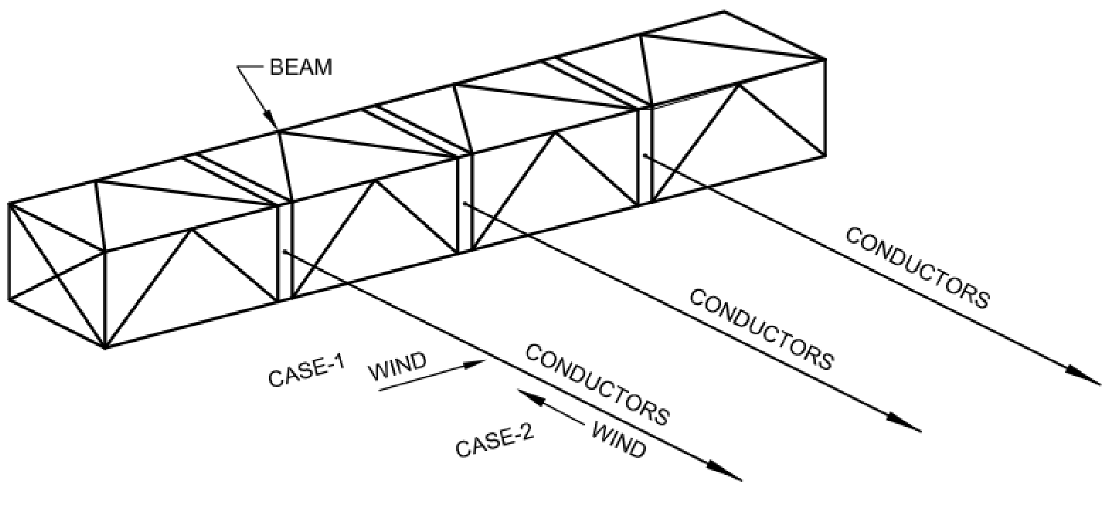


Fig. 8 Two Distinct Cases of Wind Flow

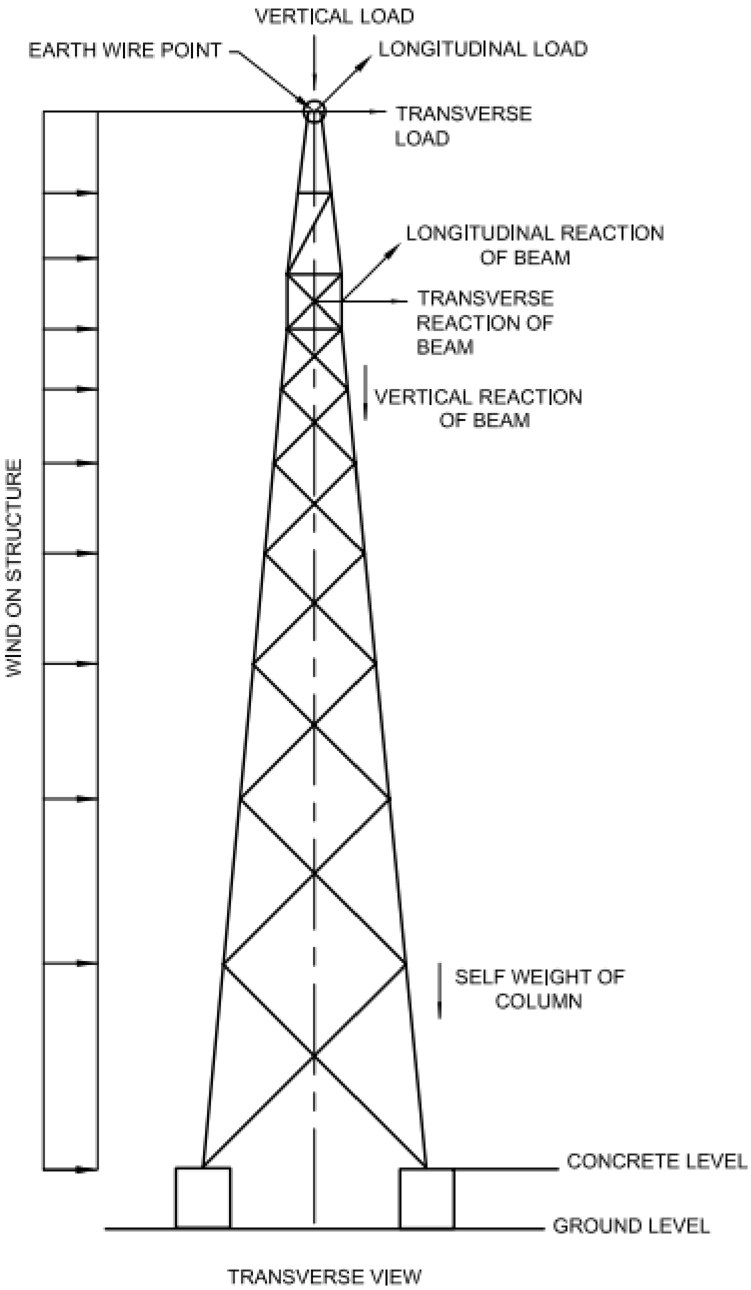


Fig. 9 Loading on Column

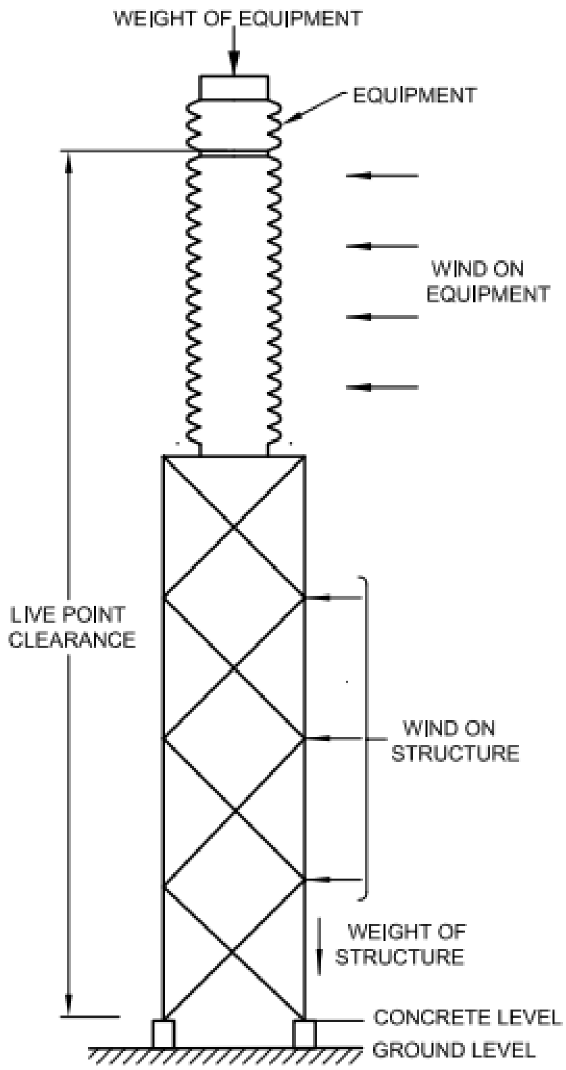


FIG. 10 LOADING ON EQIPMENT SUPPORT STRUCTRE

13 LOAD COMBINATIONS

13.1 Reliability Conditions (Normal Conditions)

a) Transverse loads as per **11.1.1**;
b) Vertical loads as per **11.2.1**; and
c) Longitudinal loads as per **11.3.1** or **11.3.2**.

13.2 Beams and column shall be designed for the following loading condition:

a) *Case* 1
   1) Reliability + wind perpendicular to beam (parallel to conductors) + vertical deviation + horizontal deviation.
   2) Security (S.C.F.) + wind perpendicular to beam (parallel to conductors) + vertical deviation + horizontal deviation.
b) *Case* 2
   1) Reliability + wind parallel to beam (perpendicular to conductors) + horizontal deviation.
   2) Security (S.C.F.) + wind parallel to beam (perpendicular to conductors) + vertical deviation and horizontal deviation.

13.3 The loading of case 1, wind parallel to beam (perpendicular to conductors) be adopted with 32ºC and no wind for reliability condition and 0ºC and no wind for security (S.C.F.) condition. The columns (tower) or masts shall be designed for the following:

a) Reactions of beams at different levels derived out of combination of beams indicated in above, shall be deemed to be the acting load in respective face of the column to which the beam is attached;
b) Wind load on column as described in **8.1**; and
c) Self-weight of the column (tower) structure.

13.4 The short circuit forces shall be determined by the user and provided for the purpose of design of structures. The short circuit forces on strung conductors, pipe conductors and electrical equipment's shall be given separately by the user.

14 FACTOR OF SAFETY

14.1 Normally, switchyard structures designed as per this standard may not be type tested. Therefore, following factor of safety/overload factor shall be provided in the design of members:

a) *Normal Condition (Reliability Condition)* — In normal condition factor of safety/overload factor of 1.5 may be provided in the design of members and the bolts.
b) *Short Circuit Condition (Security Condition)* — In short circuit condition, factor of safety/overload factor of 1.2 shall be provided in the design of members and bolts.
c) Due to very short spans and very low value of tension, broken wire conditions shall not prevail on conductors and earth wire/OPGW.

ANNEX A

(*Clause* 2)

LIST OF REFFERED INDIAN STANDARDS

IS Number	*Title*
802 (Part 1/Sec 2) : 2016	Use of structural steel in overhead transmission line towers: Part 1 Material, loads and permissible stress, Section 1 Permissible stresses (*fourth revision*)
875 (Part 3) : 2015	Design loads (other than earthquake) for buildings and structures: Wind loads — Code of practice (*third revision*)
1363 (Part 3) : 2018	Hexagon head bolts, screws and nuts of product grade C: Part 3 Hexagon nuts (size range M5 to M64) (*fifth revision*)
1573 : 1986	Electroplated coating of zinc on iron and steel — Specification (*second revision*)
2016 : 1967	Plain washers — Specification (*first revision*)
2062 : 2011	Hot rolled low, medium and high tensile structural steel (*seventh revision*)
3063 : 1994	Fasteners — Single coil rectangular section spring lock washers — Specification (*second revision*)
3757 : 1985	High strength structural bolts — Specification (*second revision*)
4759 : 1996	Hot-dip zinc coating on structural steel and other allied products — Specification (*third revision*)
5613 (Part 2/Sec1) : 1985	Design, installation and maintenance of overhead power lines: Part 2 Lines above 11 kV and up to and including 220 kV, Section 1 Design — Code of practice (*first revision*)
5624 : 2021	Foundation bolts — Specification (*second revision*)
6610 : 1972	Heavy washers for steel structures — Specification
6639 : 1972	Hexagon bolts for steel structures — Specification
6623 : 2004	High strength structural nuts — Specification (*second revision*)
6649 : 1985	Hardened and tempered washers for high strength structural bolts and nuts — Specification (*first revision*)
10238 : 2001	Fasteners — Threaded steel fasteners — Step bolts for steel structures — Specification (*first revision*)
12427 : 2001	Fasteners — Threaded steel fasteners — Hexagon head transmission tower bolts — Specification (*first revision*)

ANNEX B

(*Foreword*)

COMMITTEE COMPOSTION

Structural Engineering and Structural Sections Sectional Committee, CED 07

Organization	*Representative(s)*
In Personal Capacity (*Block 2, Flat 2A, Rani Meyyammai Tower, MRC Nagar, RA Puram, Chennai 600028*)	Dr V. Kalyanaraman (***Chairman***)
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Central Public Works Department, New Delhi	Shri D. K. Garg Shri N. K. Bansal (*Alternate*)
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GAIL India Limited, New Delhi	Shri Ashish Vaidya
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Institute for Steel Development and Growth, Kolkata	Shri Arijit Guha Shri Lakhamana Rao Pydi (*Alternate*)
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Larsen and Toubro Limited, Chennai	Shri T. Venkatesh Rao Shrimati M. F. Febin (*Alternate*)
M N Dastur and Company Private Limited, Kolkata	Shri Shuvendu Chattopadhyay Shri Gargi Aditya Basu (*Alternate* I) Shri Mohua Chatterjee (*Alternate* II)
MECON Limited, Ranchi	Shri B. K. Pandey Shri J. K. Sarkar (*Alternate*)
Military Engineer Services, Engineer-in-Chief's Branch, Integrated HQ of MoD (Army), New Delhi	Brig Girish Joshi Lt Col Gaurav Kaushik (*Alternate*)
NTPC Limited, Noida	Shri Himanshu Kundu Shri Chander Shekhar (*Alternate*)

Organization	*Representative(s)*
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Research, Designs and Standards Organization, Lucknow	Director (B and S)/SB-II Director (B and S)/SB-I (*Alternate*)
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Steel Re-Rolling Mills Association of India, Kolkata	Shri B. M. Beriwala Shri Rajesh Vijayavergia (*Alternate*)
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Tata Consulting Engineers Limited, Mumbai	Ms Surovi Ganguly Shri Shriprasad T. (*Alternate*)
The Institution of Engineers (India), Kolkata	Representative
In Personal Capacity (*A/197 Vishwamitry Township, Opp Gujarat Tractors, Vadodara 390011*)	Shri S. M. Takalkar
BIS Directorate General	Shri Arunkumar S., Scientist 'E' and Head (Civil Engineering) [Representing Director General (*Ex-officio*)]

Member Secretary

Shri Abhishek Pal
Scientist 'C' (Civil Engineering), BIS

Use of Steel in Overhead Line Towers and Switchyard Structures and Masts for Telecommunication and Flood Lighting Subcommittee, CED 7:1

Organization	*Representative(s)*
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GTL Limited, Navi Mumbai	Shri Girish Garg Shri Sudhir Bhise (*Alternate*)
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